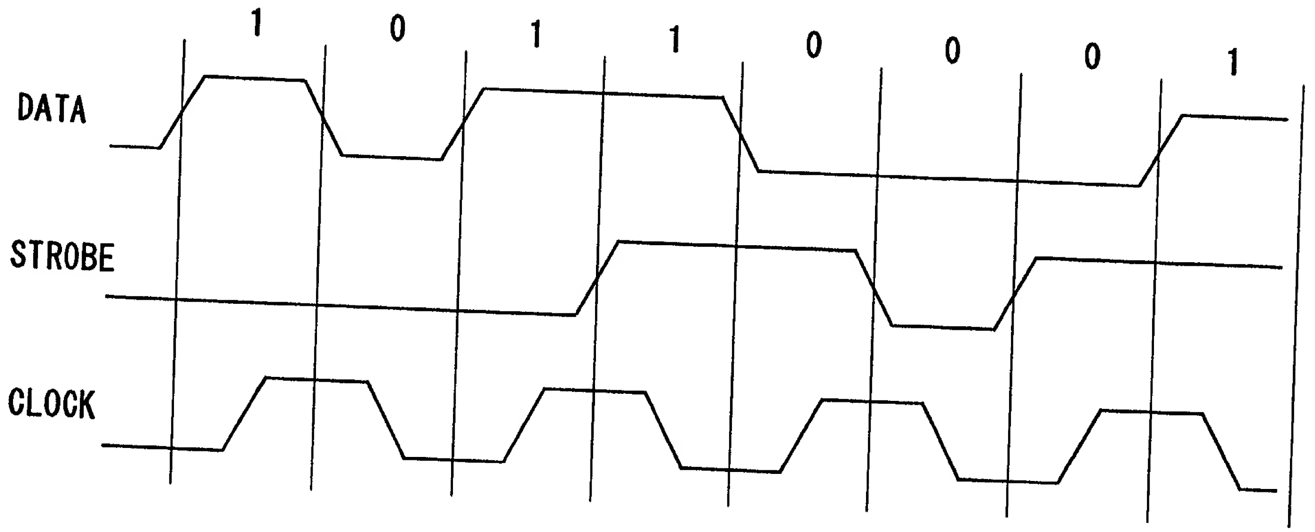
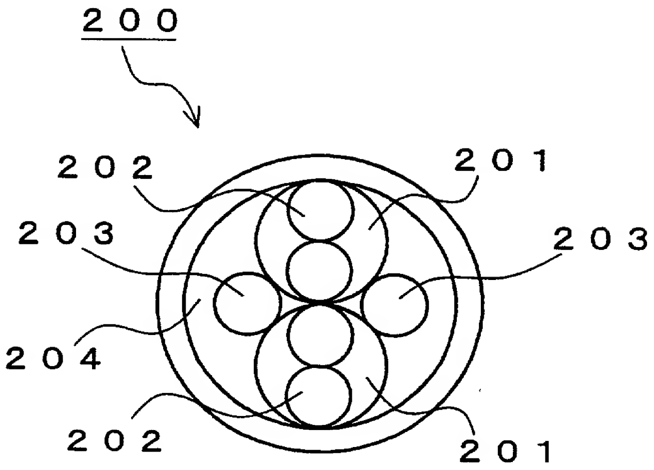
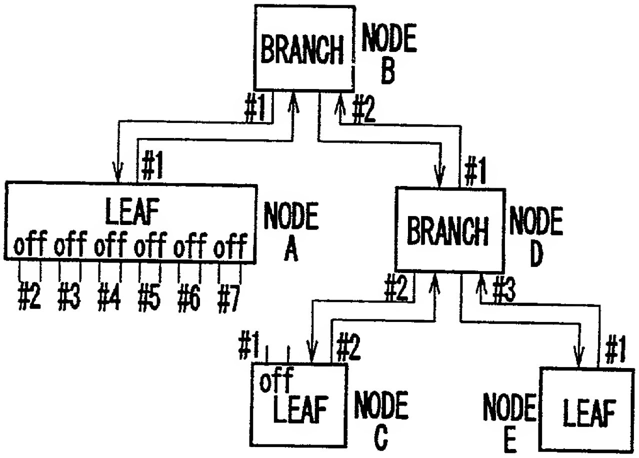
F I G. 1



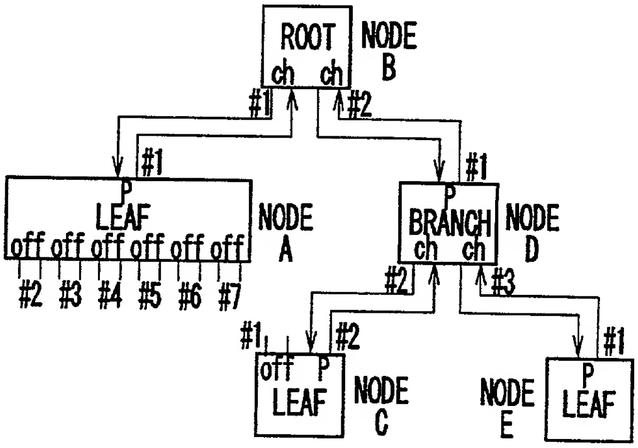
F I G. 2



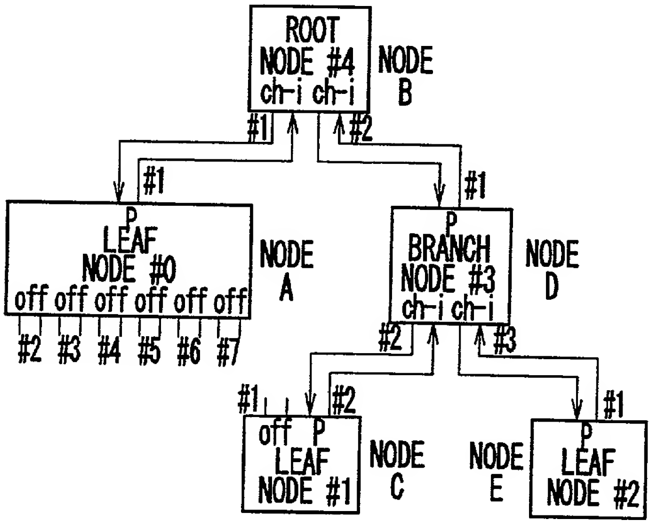
F I G. 3 A
(BUS INITIALIZATION)



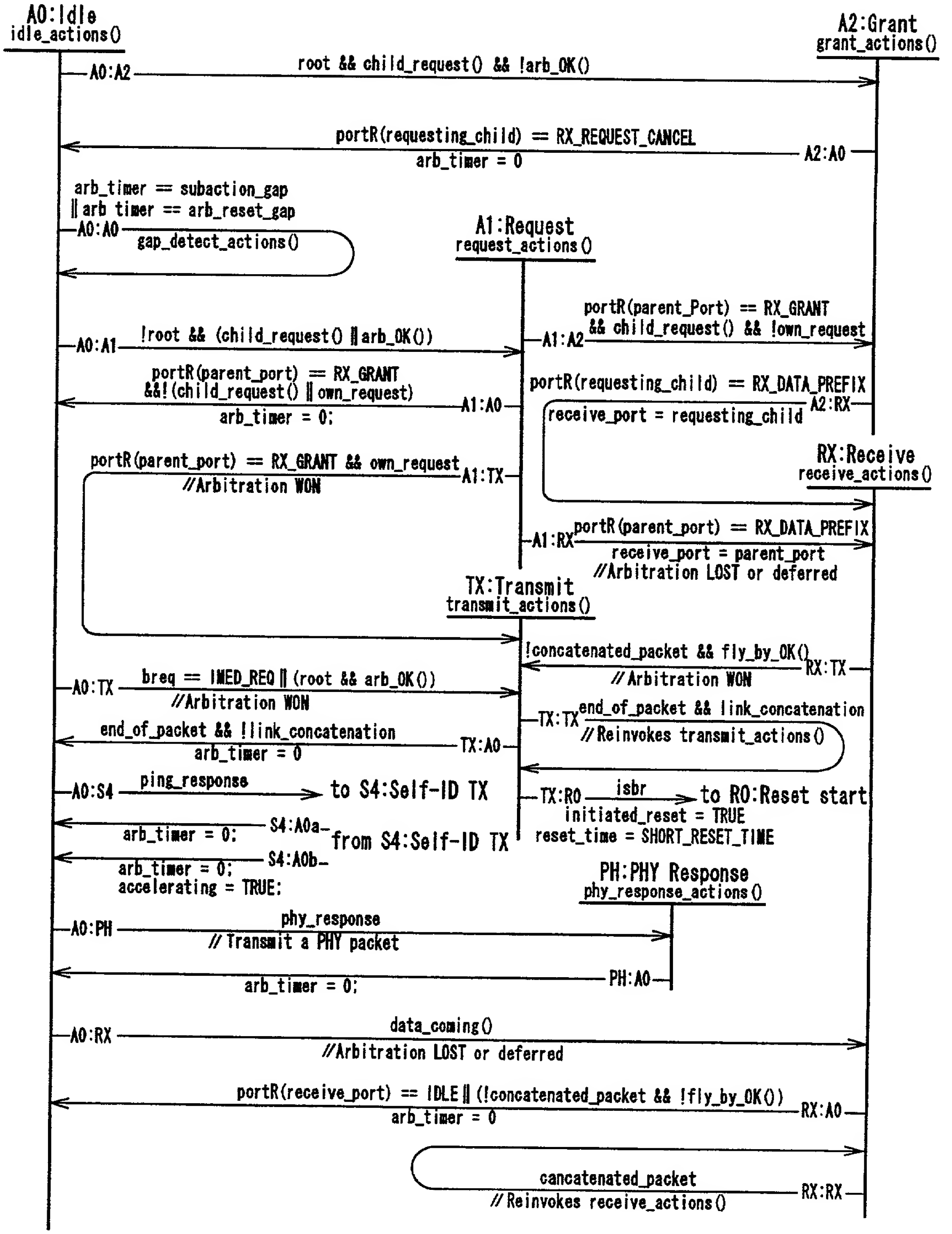
F I G. 3 B
(TREE IDENTIFICATION)



F I G. 3 C
(SELF IDENTIFICATION)

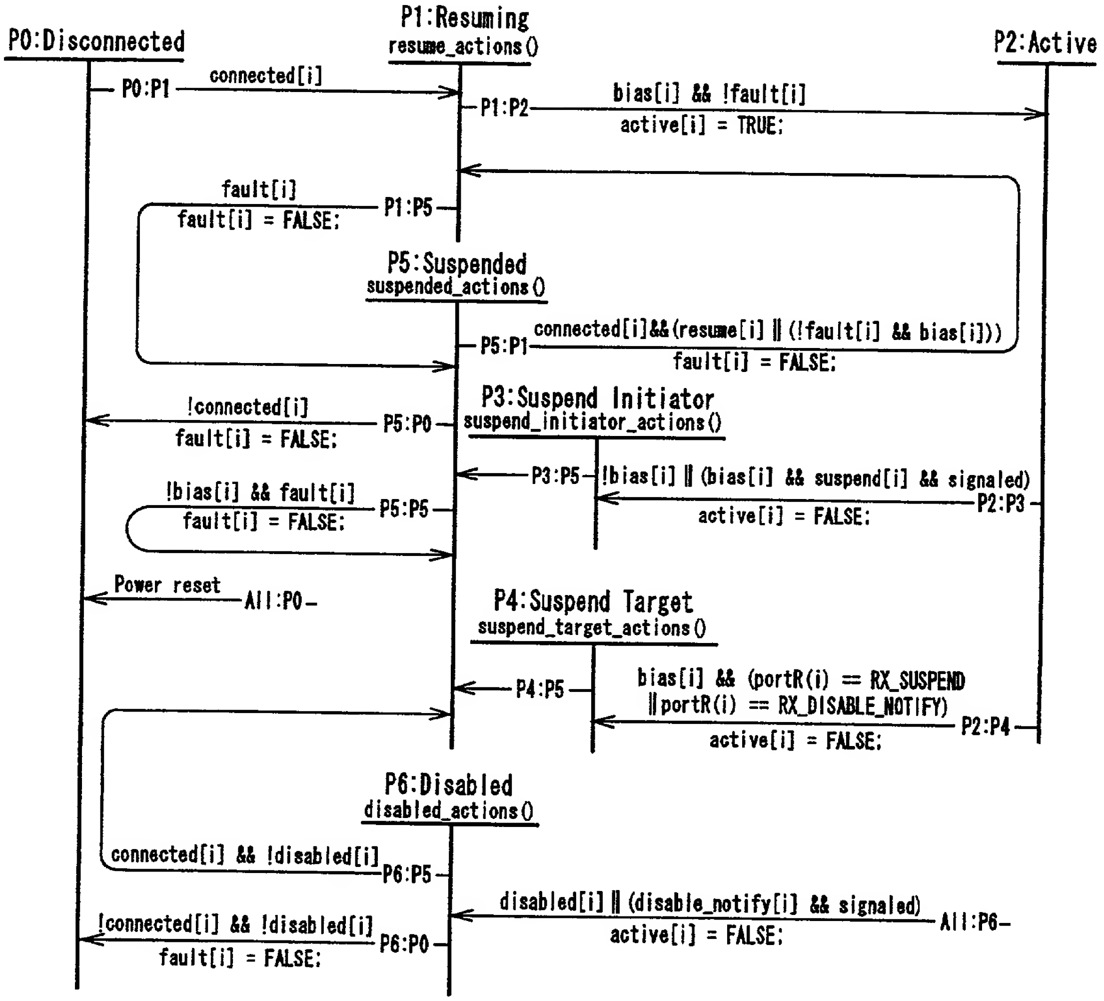


F I G. 4

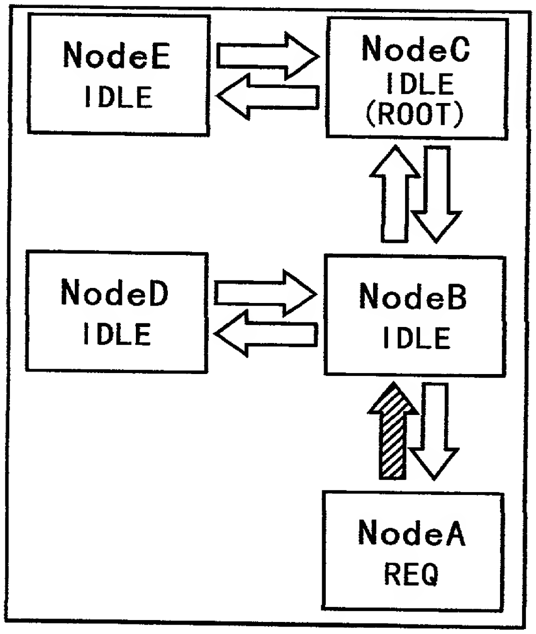


A0:Idle
idle_actions()
A2:Grant
grant_actions()
A0:A2
root && child_request() && !arb_OK()
portR(requesting_child) == RX_REQUEST_CANCEL
arb_timer = 0
A2:A0
arb_timer == subaction_gap
‖arb timer == arb_reset_gap
A0:A0
gap_detect_actions()
A1:Request
request_actions()
portR(parent_Port) == RX_GRANT
&& child_request() && !own_request
A0:A1
!root && (child_request() ‖arb_OK())
A1:A2
portR(parent_port) == RX_GRANT
&&!(child_request() ‖ own_request)
arb_timer = 0;
A1:A0
portR(requesting_child) == RX_DATA_PREFIX
receive_port = requesting_child
A2:RX
RX:Receive
receive_actions()
portR(parent_port) == RX_GRANT && own_request
//Arbitration WON
A1:TX
A1:RX
portR(parent_port) == RX_DATA_PREFIX
receive_port = parent_port
//Arbitration LOST or deferred
TX:Transmit
transmit_actions()
!concatenated_packet && fly_by_OK()
//Arbitration WON
RX:TX
A0:TX
breq == IMED_REQ ‖ (root && arb_OK())
//Arbitration WON
TX:TX
end_of_packet && link_concatenation
//Reinvokes transmit_actions()
end_of_packet && !link_concatenation
arb_timer = 0
TX:A0
A0:S4
ping_response
to S4:Self-ID TX
TX:R0
isbr
to R0:Reset start
initiated_reset = TRUE
reset_time = SHORT_RESET_TIME
arb_timer = 0;
S4:A0a
from S4:Self-ID TX
S4:A0b
arb_timer = 0;
accelerating = TRUE;
PH:PHY Response
phy_response_actions()
A0:PH
phy_response
// Transmit a PHY packet
PH:A0
arb_timer = 0;
A0:RX
data_coming()
//Arbitration LOST or deferred
portR(receive_port) == IDLE ‖ (!concatenated_packet && !fly_by_OK())
arb_timer = 0
RX:A0
cancatenated_packet
//Reinvokes receive_actions()
RX:RX

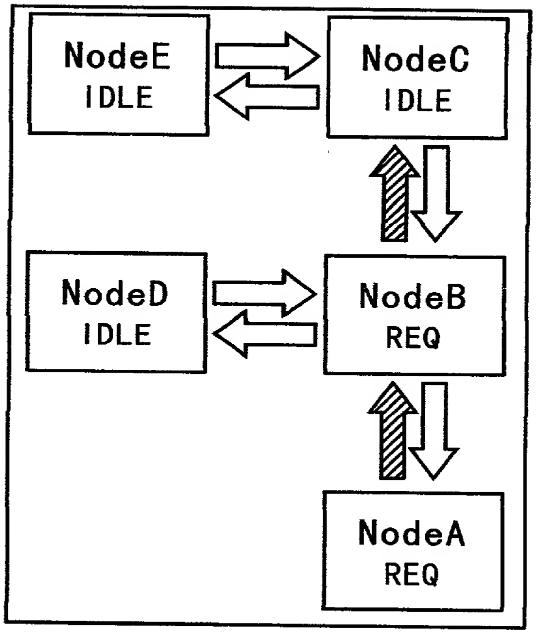
FIG. 5


P0:Disconnected
P1:Resuming
resume_actions()
P2:Active
P0:P1
connected[i]
P1:P2
bias[i] && !fault[i]
active[i] = TRUE;
fault[i]
fault[i] = FALSE;
P1:P5
P5:Suspended
suspended_actions()
P5:P1
connected[i]&&(resume[i] || (!fault[i] && bias[i]))
fault[i] = FALSE;
!connected[i]
fault[i] = FALSE;
P5:P0
P3:Suspend Initiator
suspend_initiator_actions()
P3:P5
!bias[i] || (bias[i] && suspend[i] && signaled)
active[i] = FALSE;
P2:P3
!bias[i] && fault[i]
fault[i] = FALSE;
P5:P5
Power reset
All:P0
P4:Suspend Target
suspend_target_actions()
P4:P5
bias[i] && (portR(i) == RX_SUSPEND
||portR(i) == RX_DISABLE_NOTIFY)
active[i] = FALSE;
P2:P4
P6:Disabled
disabled_actions()
connected[i] && !disabled[i]
P6:P5
disabled[i] || (disable_notify[i] && signaled)
active[i] = FALSE;
All:P6
!connected[i] && !disabled[i]
fault[i] = FALSE;
P6:P0

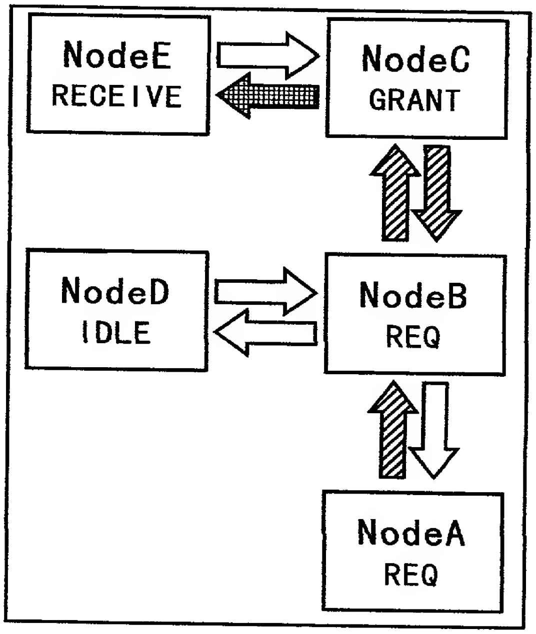
F I G. 6 A



F I G. 6 B



F I G. 6 C



F I G. 6 D

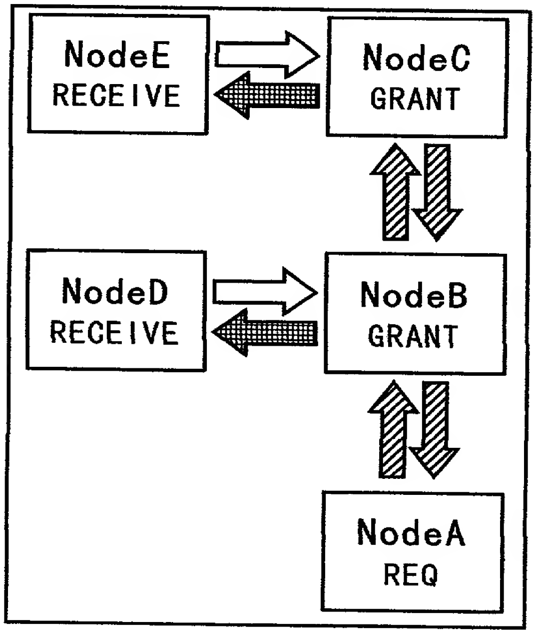


FIG. 7A

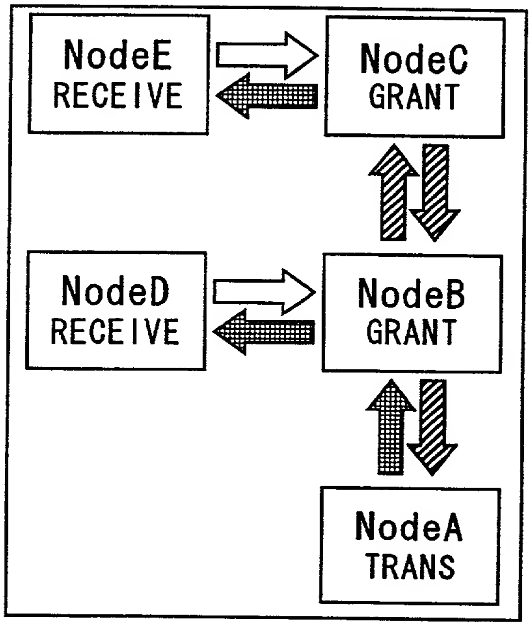


FIG. 7B

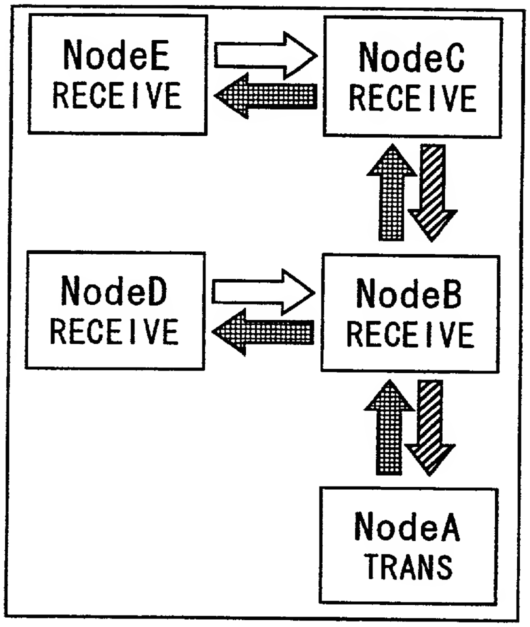


FIG. 7C

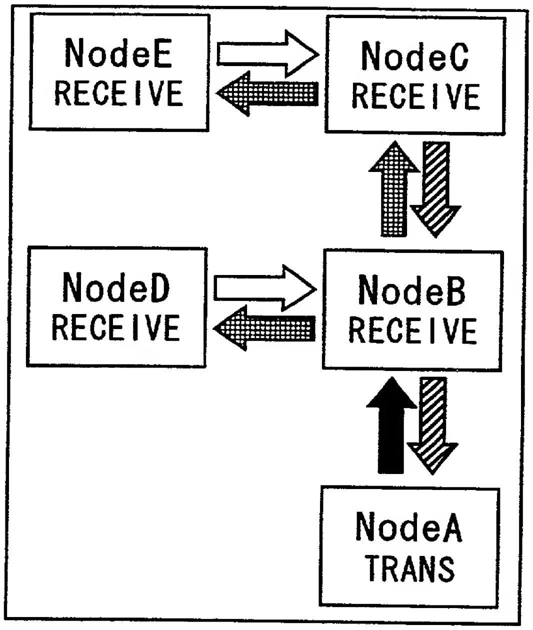


FIG. 7D

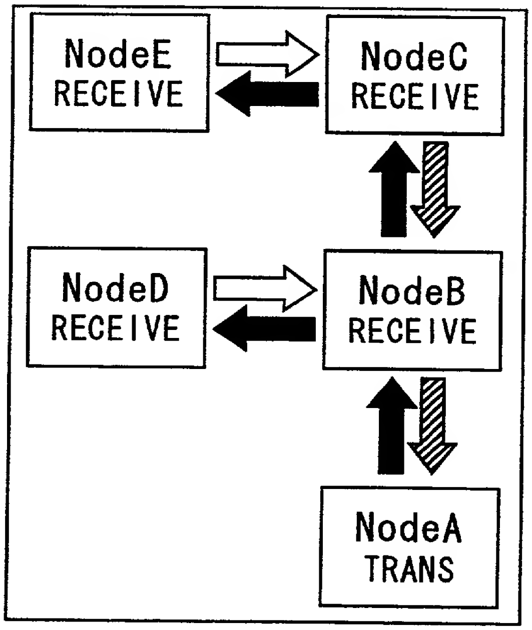


FIG. 8A

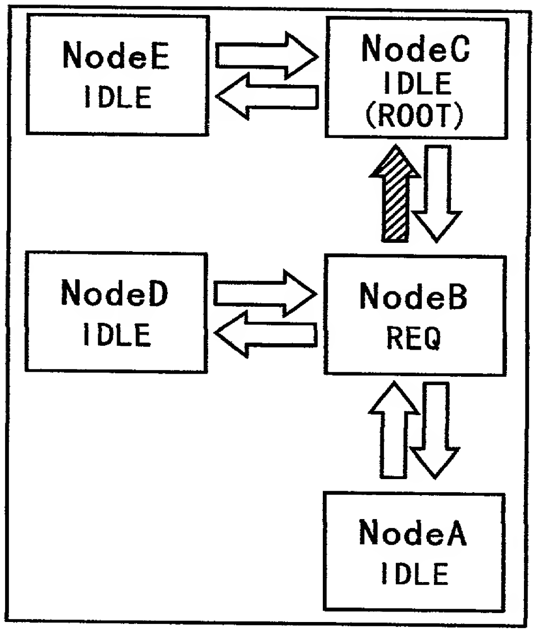


FIG. 8B

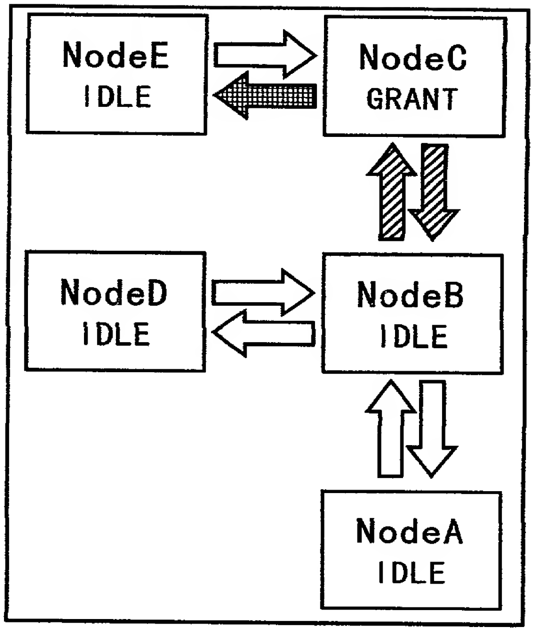
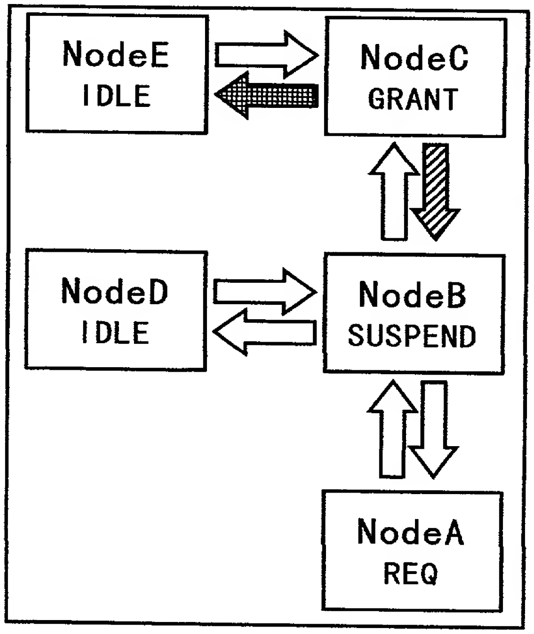
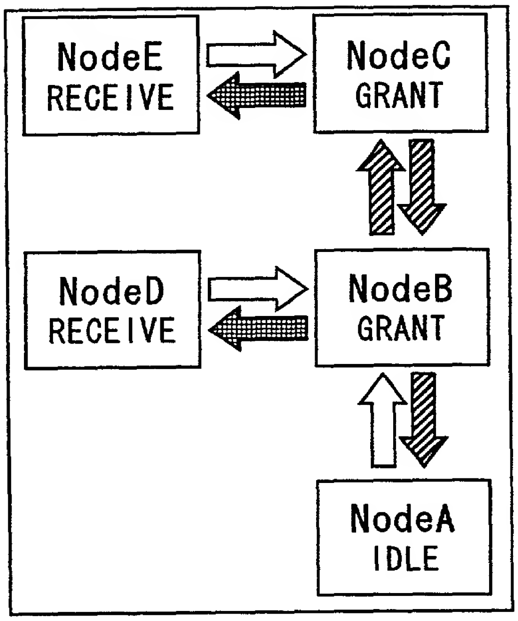


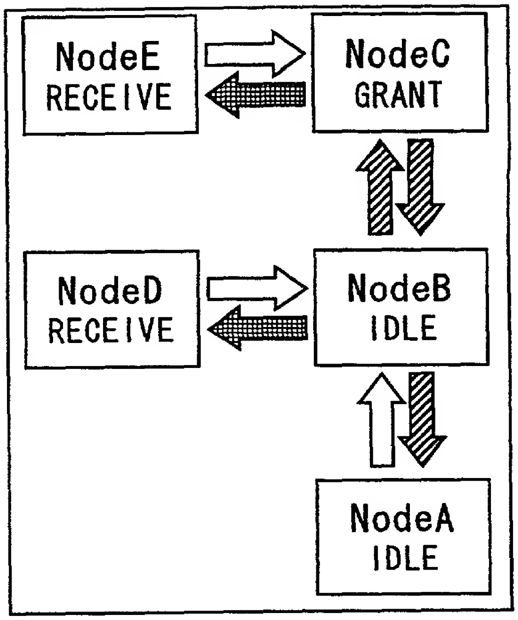
FIG. 8C



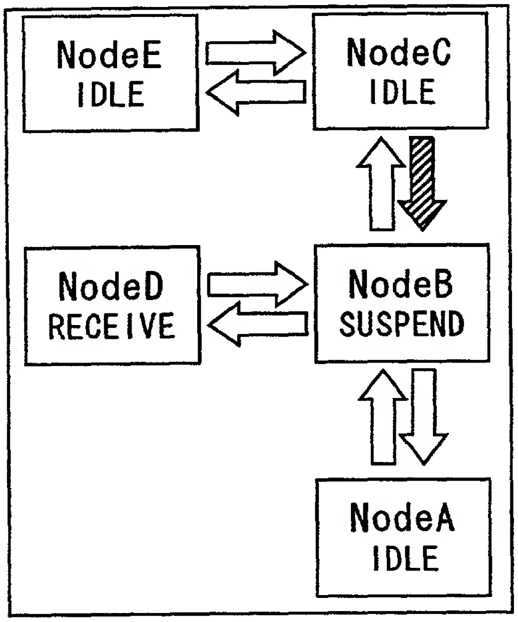
F I G. 9 A



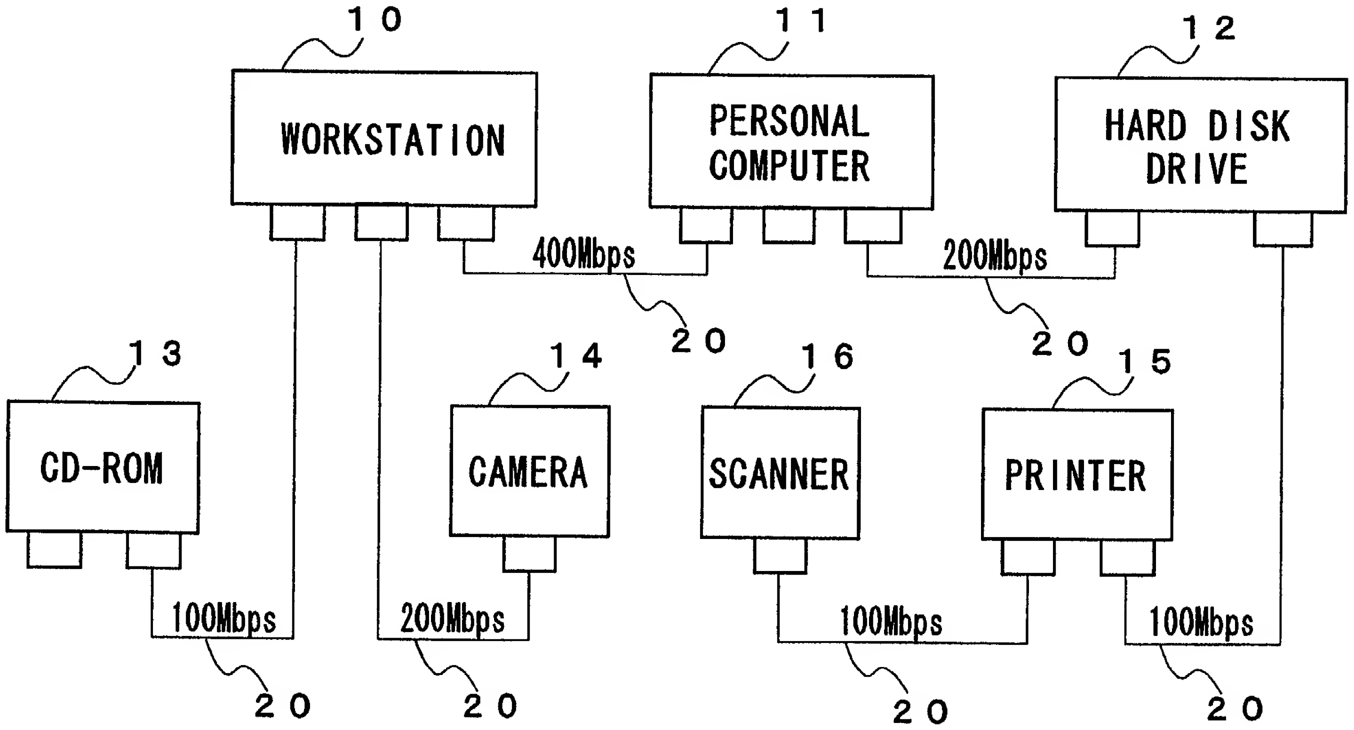
F I G. 9 B



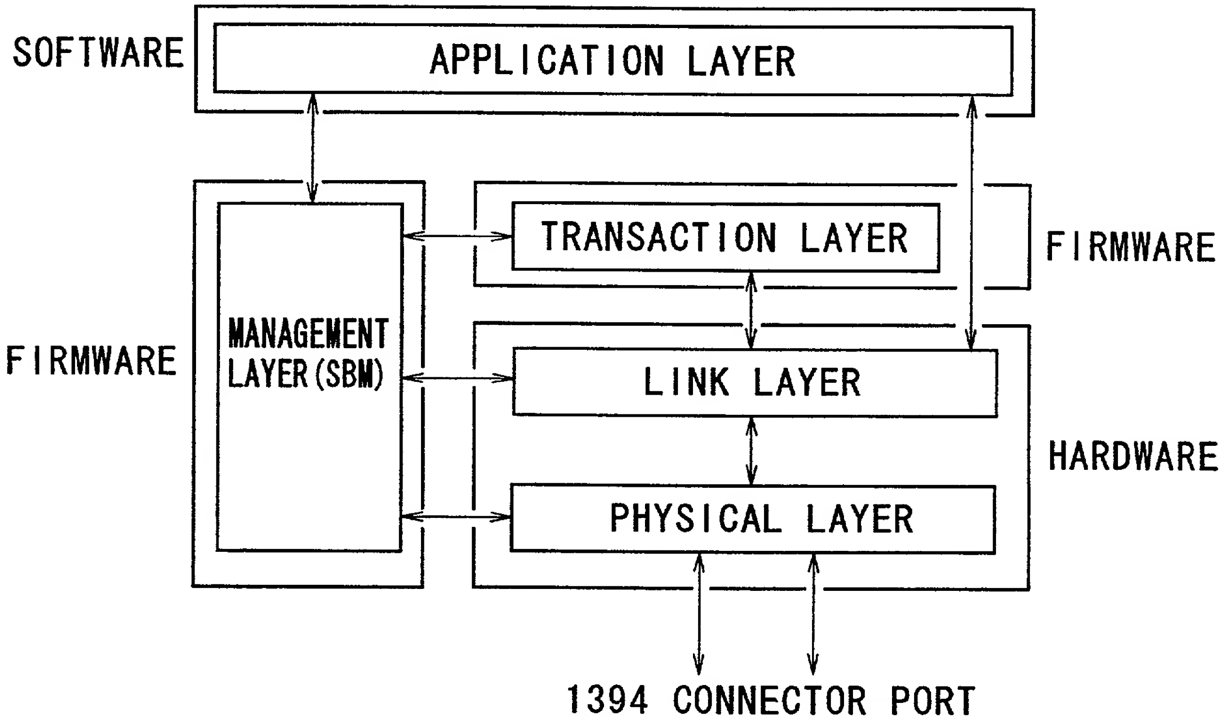
F I G. 9 C



F I G. 1 0


1 0
WORKSTATION
1 1
PERSONAL COMPUTER
1 2
HARD DISK DRIVE
400Mbps
2 0
200Mbps
2 0
1 3
CD-ROM
1 4
CAMERA
1 6
SCANNER
1 5
PRINTER
100Mbps
2 0
200Mbps
2 0
100Mbps
2 0
100Mbps
2 0

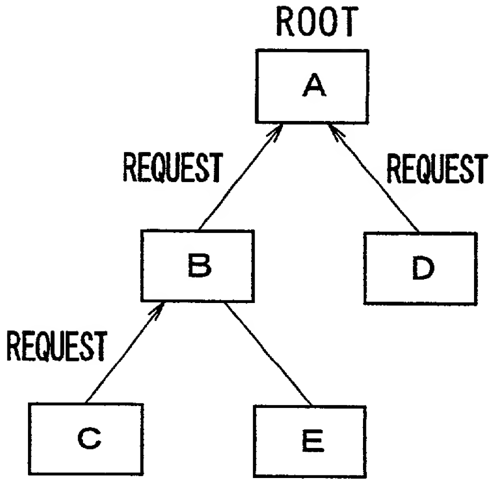
F I G. 1 1


SOFTWARE
APPLICATION LAYER
FIRMWARE
MANAGEMENT LAYER (SBM)
TRANSACTION LAYER
FIRMWARE
LINK LAYER
HARDWARE
PHYSICAL LAYER
1394 CONNECTOR PORT

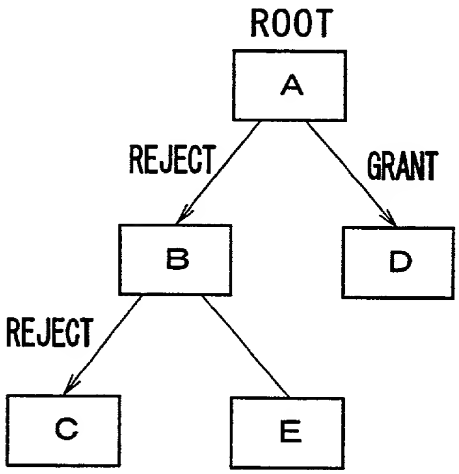
F I G. 1 2


Subaction gap
arbitration
packet
Ack gap
Ack
Subaction gap

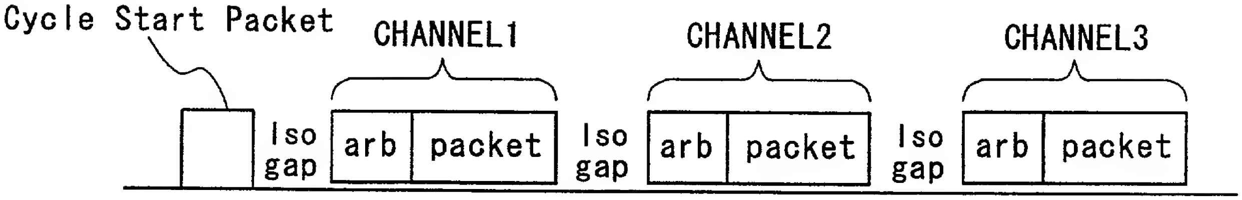
F I G. 1 3 A



F I G. 1 3 B



F I G. 1 4



F I G. 1 5

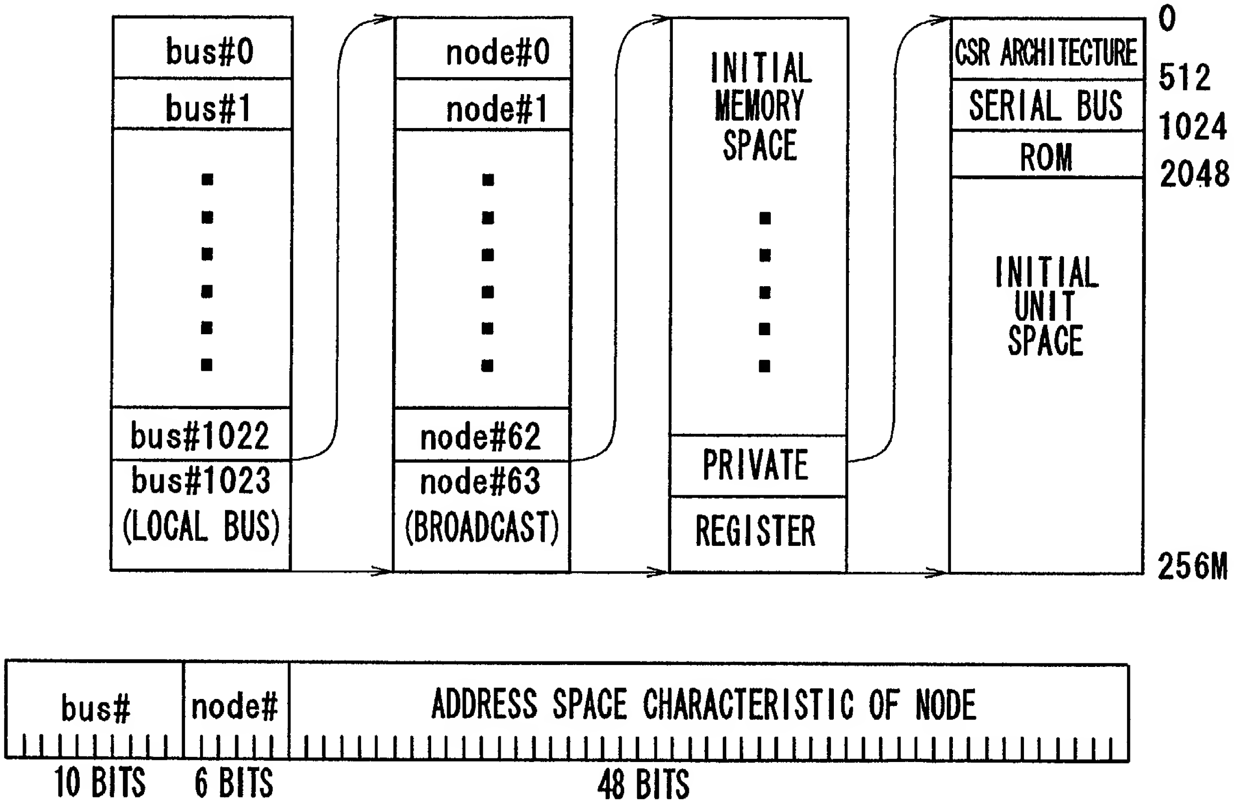
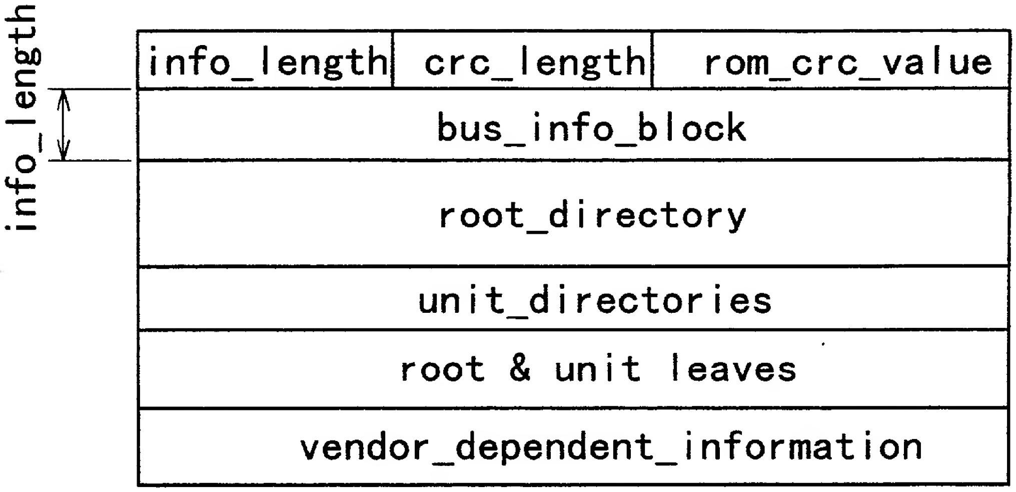

bus#0
bus#1
bus#1022
bus#1023
(LOCAL BUS)
node#0
node#1
node#62
node#63
(BROADCAST)
INITIAL
MEMORY
SPACE
PRIVATE
REGISTER
CSR ARCHITECTURE
SERIAL BUS
ROM
INITIAL
UNIT
SPACE
0
512
1024
2048
256M
bus#
node#
ADDRESS SPACE CHARACTERISTIC OF NODE
10 BITS
6 BITS
48 BITS

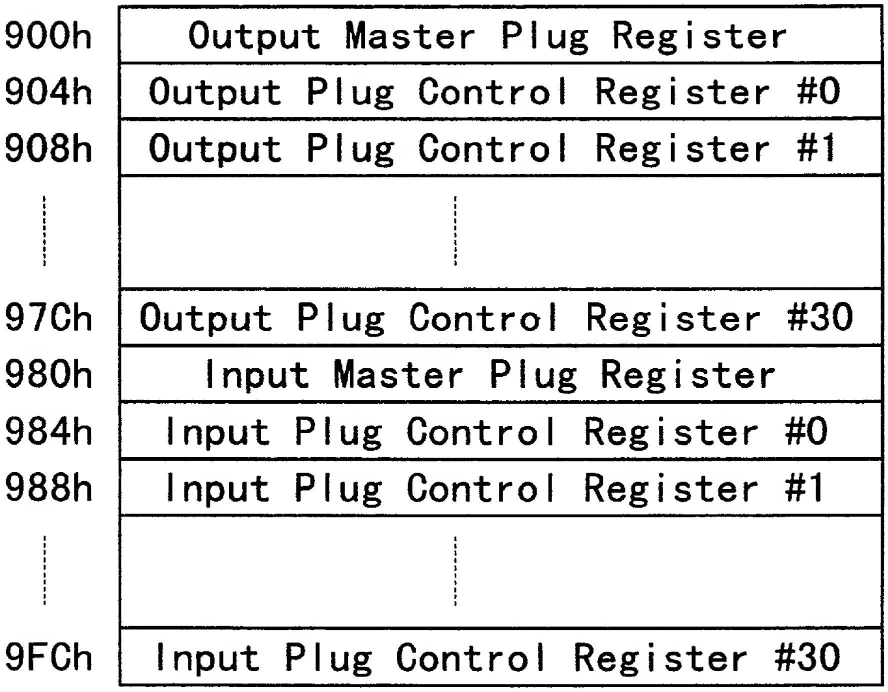
FIG. 16

OFFSETS	NAMES	FUNCTIONS
000h	STATE_CLEAR	STATE AND CONTROL INFORMATION
004h	STATE_SET	SET STATE_CLEAR BIT
008h	NODE_IDs	INDICATE 16-BIT NODE ID
00Ch	RESET_START	START COMMAND RESET
018h-01Ch	SPLIT_TIMEOUT	PRESCRIBE MAXIMUM TIME OF SPLIT
200h	CYCLE_TIME	CYCLE TIME
210h	BUSY_TIMEOUT	PRESCRIBE LIMIT OF RETRY
21Ch	BUS_MANAGER	INDICATE BUS MANAGER ID
220h	BANDWIDTH_AVAILABLE	INDICATE BANDWIDTH THAT CAN BE ASSIGNED TO ISOCHRONOUS COMMUNICATION
224h-228h	CHANNELS_AVAILABLE	INDICATE USED STATE OF EACH CHANNEL

F I G. 1 7



F I G. 1 9



900h	Output Master Plug Register
904h	Output Plug Control Register #0
908h	Output Plug Control Register #1
⋮	⋮
97Ch	Output Plug Control Register #30
980h	Input Master Plug Register
984h	Input Plug Control Register #0
988h	Input Plug Control Register #1
⋮	⋮
9FCh	Input Plug Control Register #30

FIG. 18

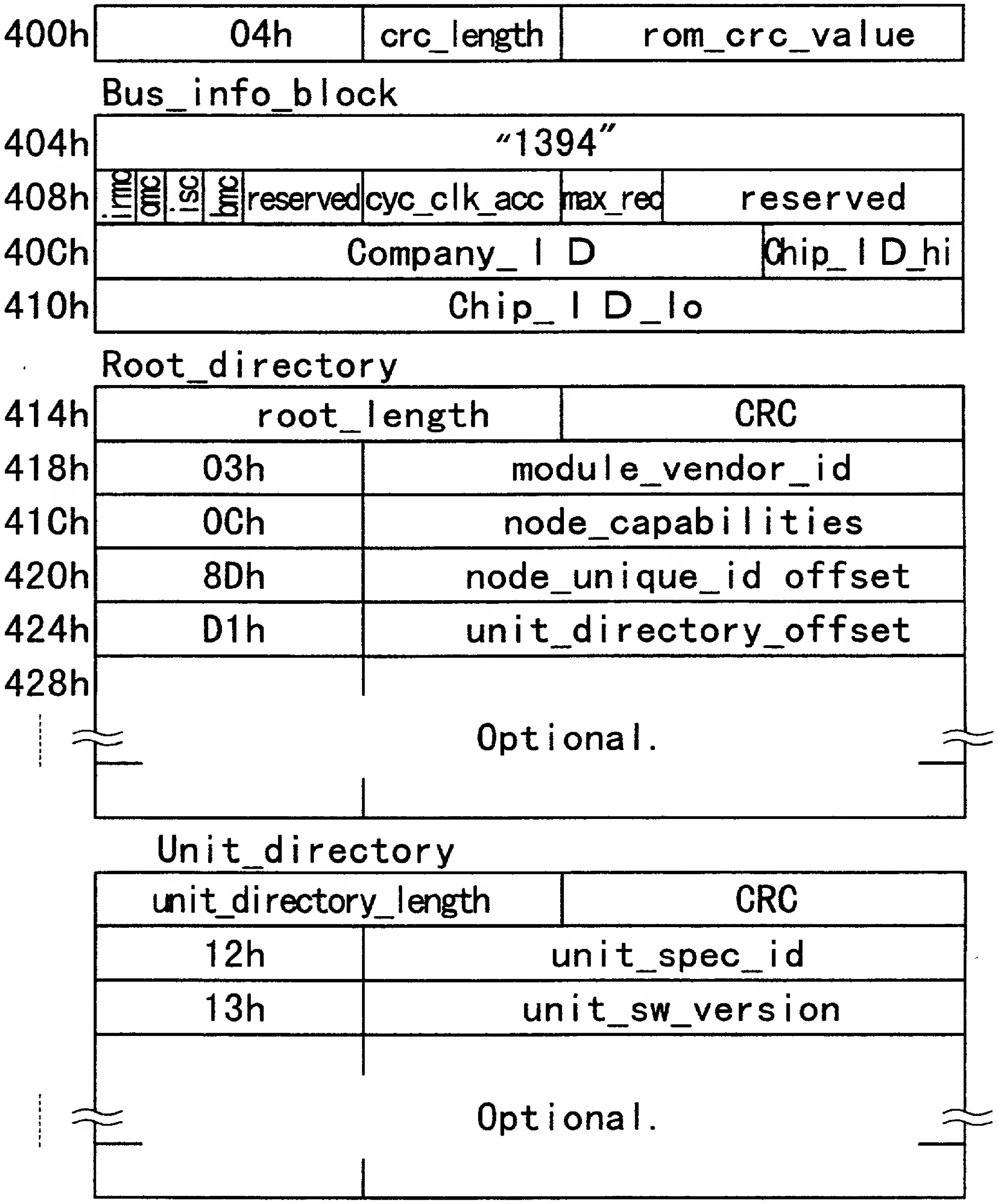

400h
04h
crc_length
rom_crc_value
Bus_info_block
404h
"1394"
408h
irmc
cmc
isc
bmc
reserved
cyc_clk_acc
max_rec
reserved
40Ch
Company_ID
Chip_ID_hi
410h
Chip_ID_lo
Root_directory
414h
root_length
CRC
418h
03h
module_vendor_id
41Ch
0Ch
node_capabilities
420h
8Dh
node_unique_id offset
424h
D1h
unit_directory_offset
428h
Optional.
Unit_directory
unit_directory_length
CRC
12h
unit_spec_id
13h
unit_sw_version
Optional.

FIG. 20A

oMPR

data rate capability	broadcast channel base	non-persistent extension field	persistent extension field	reserved	number of output plugs	
2	6	8	8	3	5	(bit)

FIG. 20B

oPCR[n]

on-line	broadcast connection counter	point-to-point connection counter	reserved	channel number	data rate	overhead ID	payload	
1	1	6	2	6	2	4	10	(bit)

FIG. 20C

iMPR

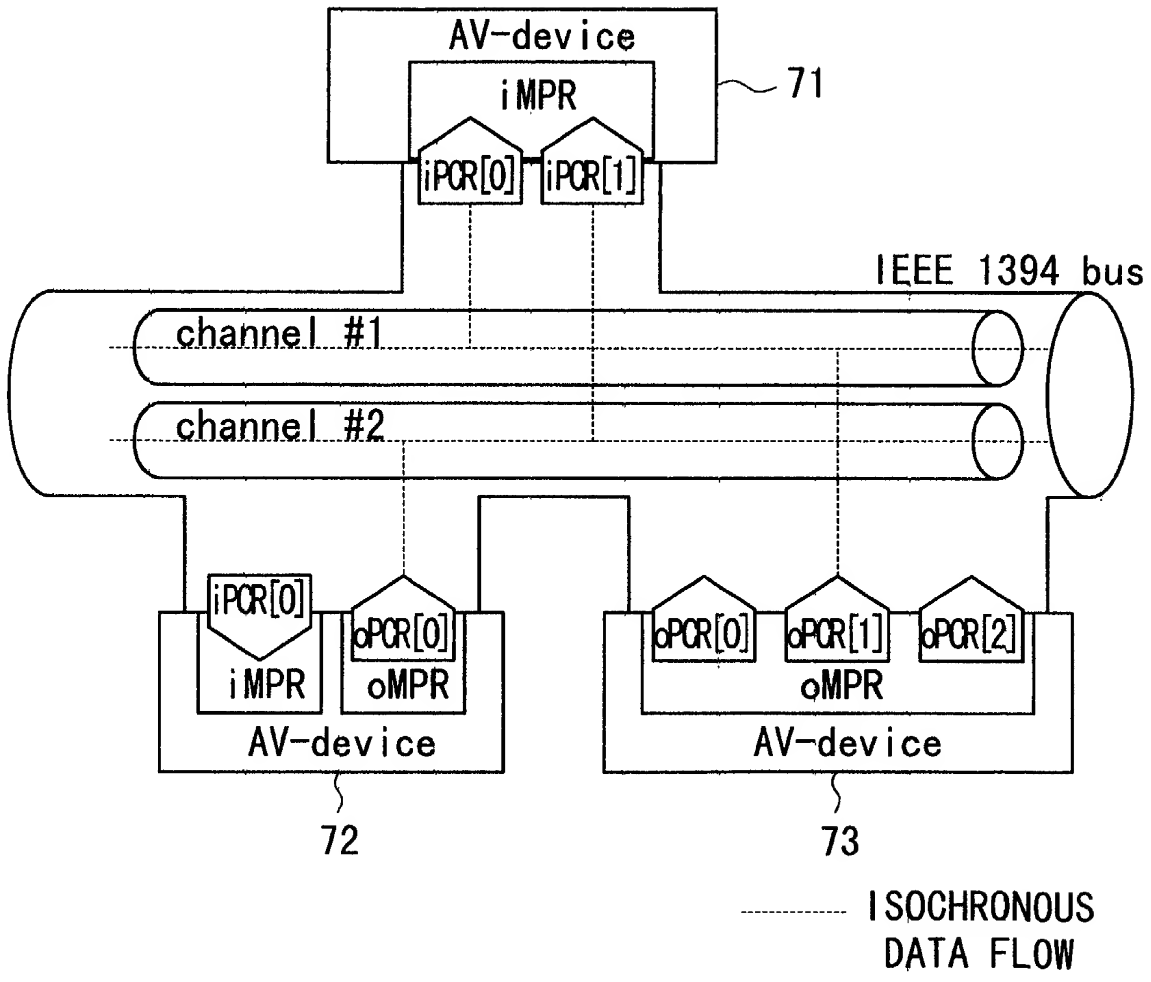
data rate capability	reserved	non-persistent extension field	persistent extension field	reserved	number of output plugs	
2	6	8	8	3	5	(bit)

FIG. 20D

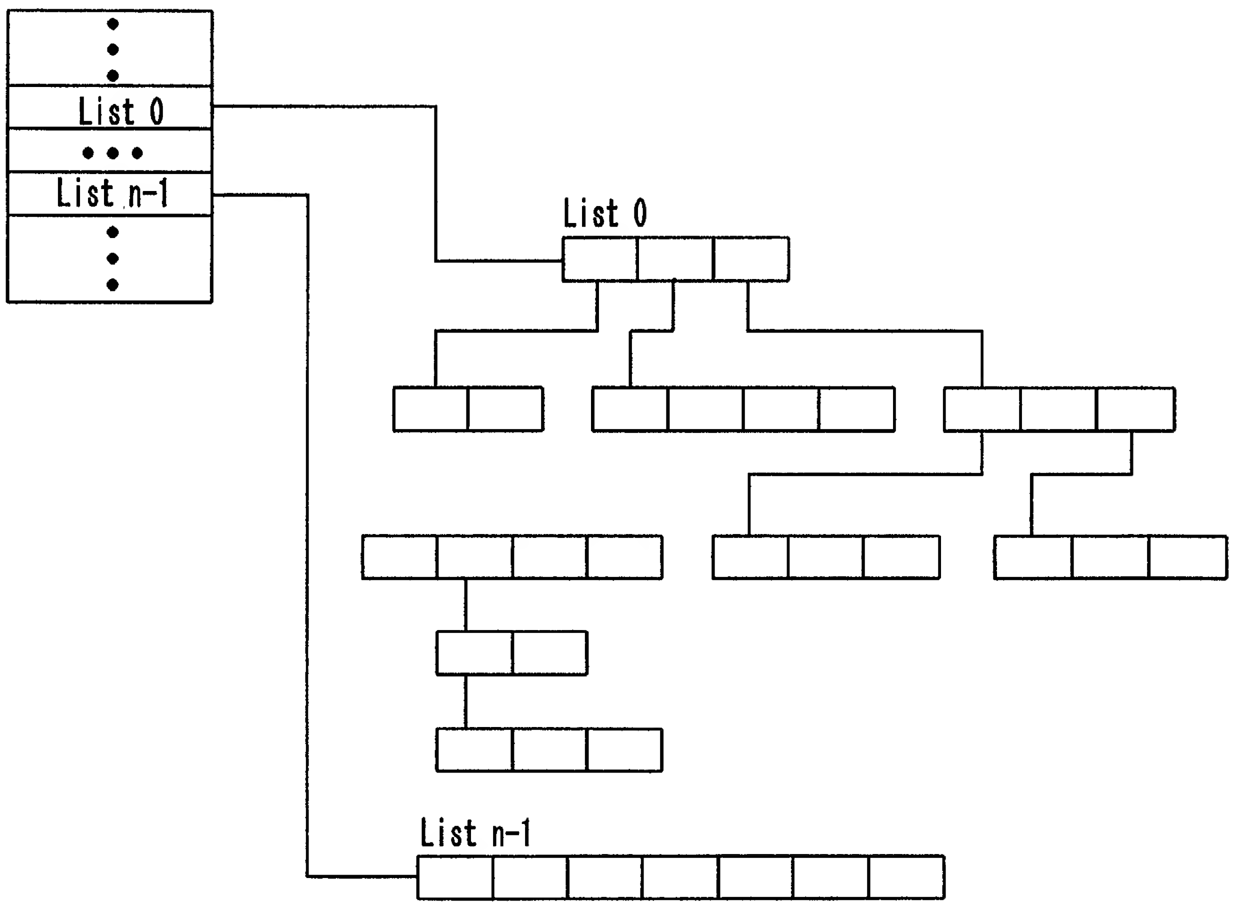
iPCR[n]

on-line	broadcast connection counter	point-to-point connection counter	reserved	channel number	reserved	
1	1	6	2	6	16	(bit)

F I G. 2 1


AV-device
iMPR
iPCR[0]
iPCR[1]
71
IEEE 1394 bus
channel #1
channel #2
iPCR[0]
iMPR
oPCR[0]
oMPR
AV-device
72
oPCR[0]
oPCR[1]
oPCR[2]
oMPR
AV-device
73
ISOCHRONOUS DATA FLOW

F I G . 2 2



F I G. 2 3

The General Subunit Identifier Descriptor	
address	contents
00 00_{16}	descriptor_length
00 01_{16}	
00 02_{16}	generation_ID
00 03_{16}	size_of_list_ID
00 04_{16}	size_of_object_ID
00 05_{16}	size_of_object_position
00 06_{16}	number_of_root_object_lists(n)
00 07_{16}	
00 08_{16}	root_object_list_id_0
⋮	
⋮	⋮
⋮	root_object_list_id_n-1
⋮	
⋮	subunit_dependent_length
⋮	
⋮	subunit_dependent_information
⋮	
⋮	
⋮	manufacturer_dependent_length
⋮	
⋮	manufacturer_dependent_information
⋮	
⋮	

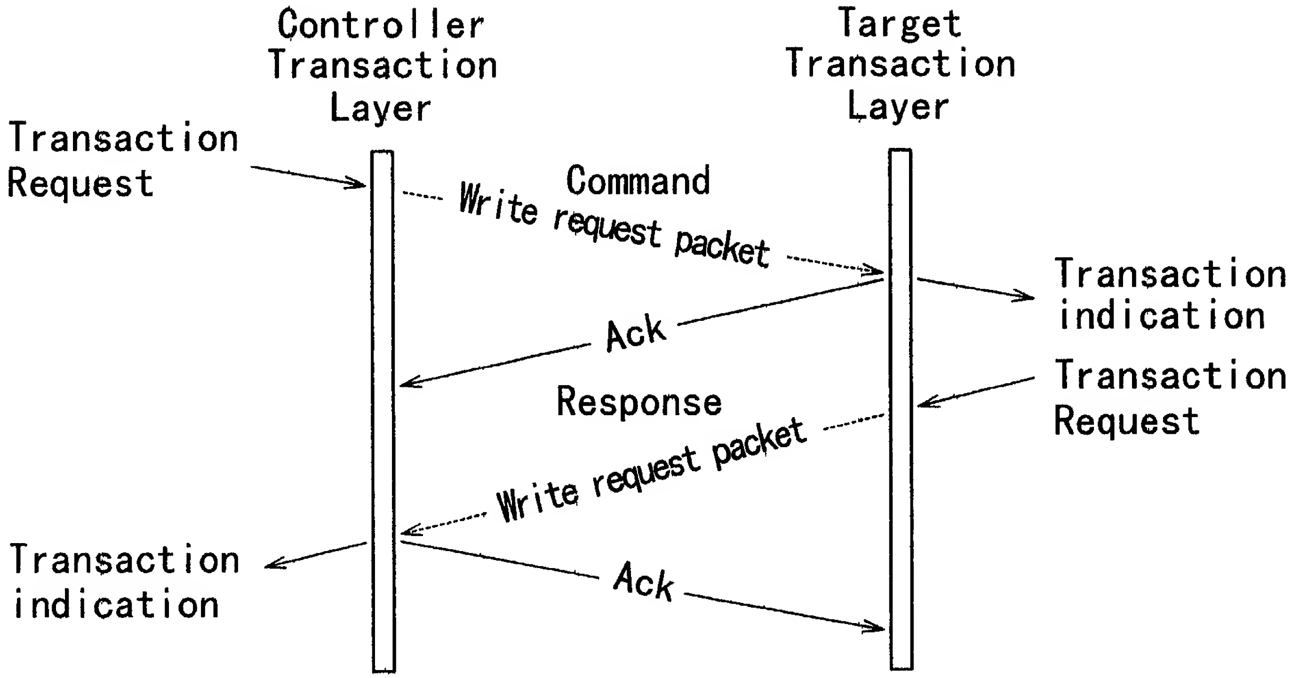
F I G. 2 4

generation_ID values	
generation_ID	meaning
00_{16}	Data structures and command sets as specified in the AV/C General Specification, version 3.0
all others	reserved for future specification

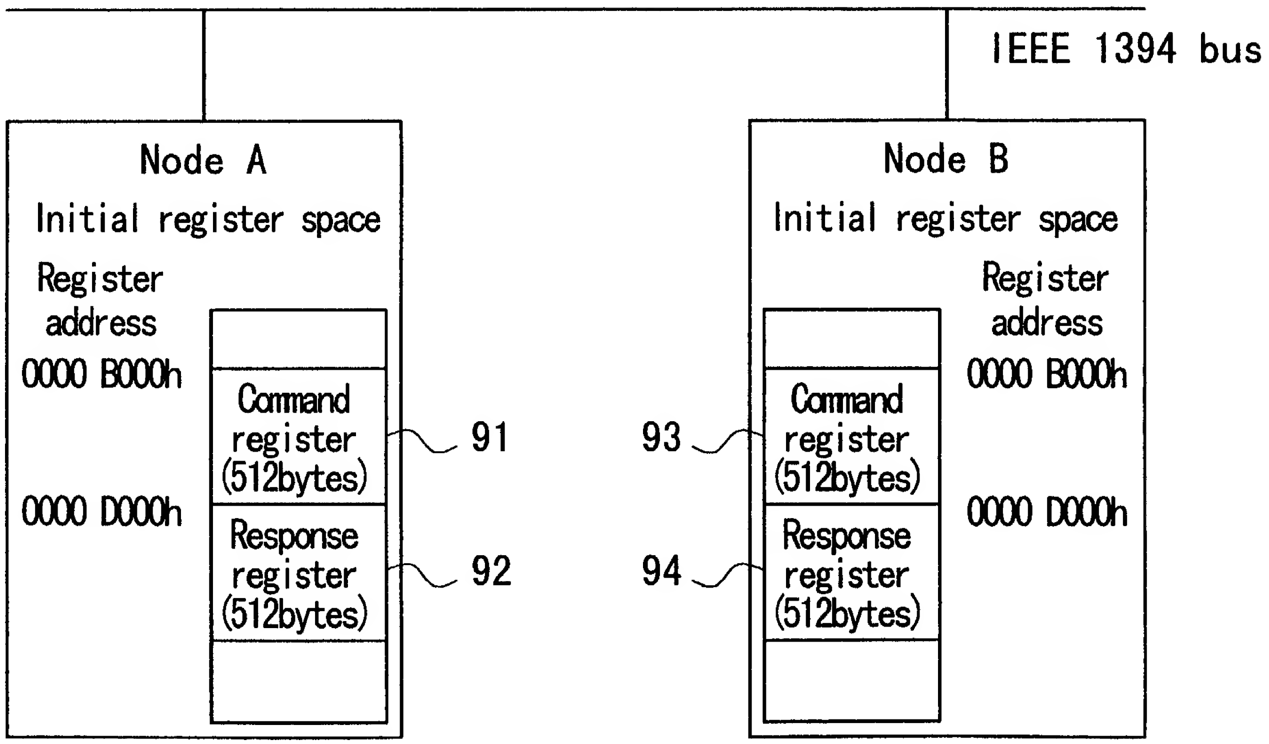
F I G. 2 5

List ID Value Assignment Ranges	
range of values	list definition
0000_{16}-$0FFF_{16}$	reserved
1000_{16}-$3FFF_{16}$	subunit-type dependent
4000_{16}-$FFFF_{16}$	reserved
1 0000_{16}-max list ID value	subunit-type dependent

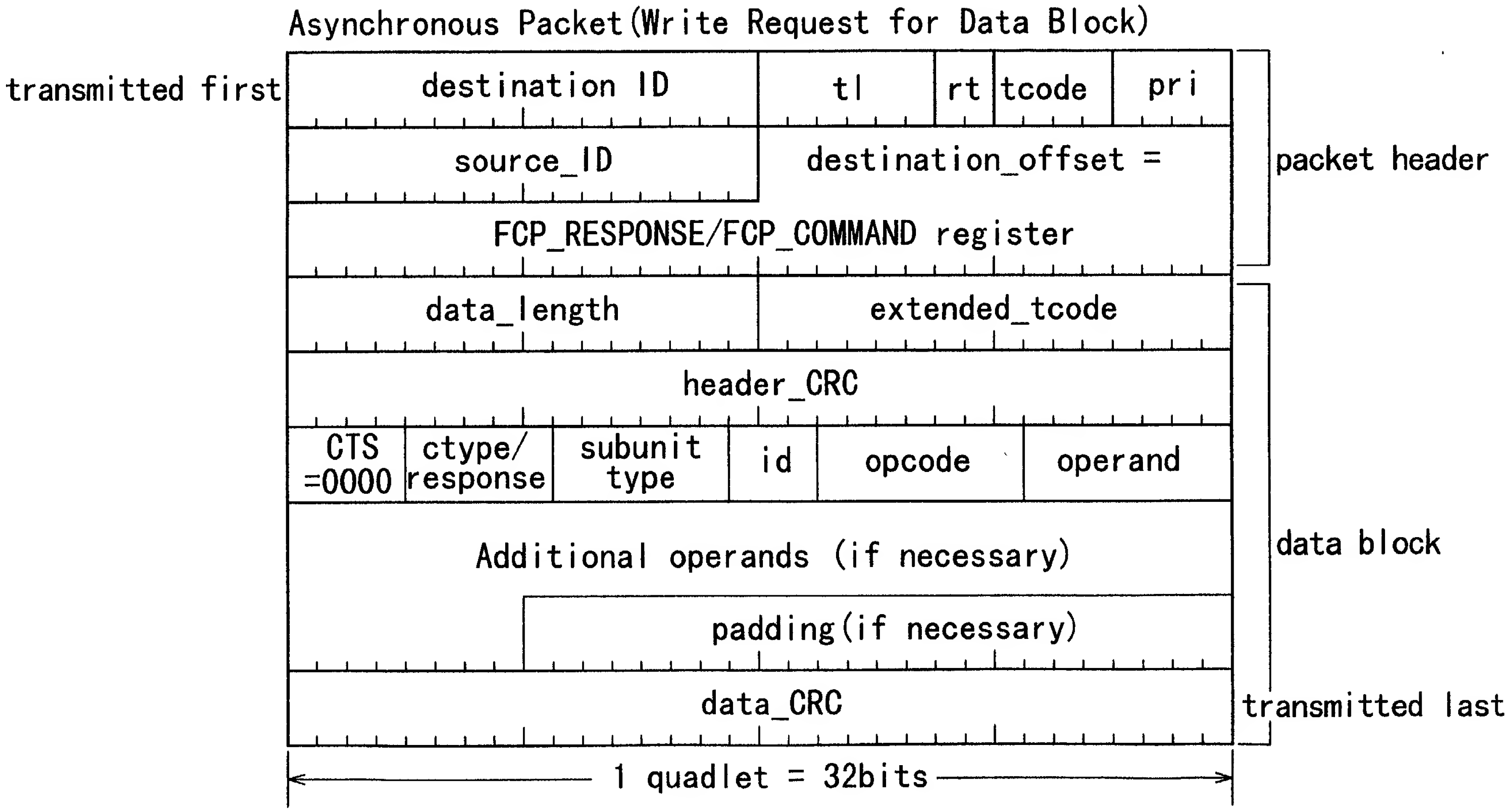
F I G. 26


Controller Transaction Layer
Target Transaction Layer
Transaction Request
Command
Write request packet
Transaction indication
Ack
Transaction Request
Response
Write request packet
Transaction indication
Ack

F I G. 27


IEEE 1394 bus
Node A
Initial register space
Register address
0000 B000h
0000 D000h
Command register (512bytes)
Response register (512bytes)
91
92
Node B
Initial register space
Register address
0000 B000h
0000 D000h
Command register (512bytes)
Response register (512bytes)
93
94

F I G. 28


Asynchronous Packet (Write Request for Data Block)
transmitted first
destination ID
tl
rt
tcode
pri
source_ID
destination_offset =
FCP_RESPONSE/FCP_COMMAND register
packet header
data_length
extended_tcode
header_CRC
CTS =0000
ctype/ response
subunit type
id
opcode
operand
Additional operands (if necessary)
padding (if necessary)
data block
data_CRC
transmitted last
1 quadlet = 32bits

ctype/response

Command	0000	CONTROL
	0001	STATUS
	0010	SPECIFIC INQUIRY
	0011	NOTIFY
	0100	GENERAL INQUIRY
	0101 ~ 0111	(reserved for future specification)
Response	1000	NOT IMPLEMENTED
	1001	ACCEPTED
	1010	REJECTED
	1011	IN TRANSITION
	1100	IMPLEMENTED/STABLE
	1101	CHANGED
	1110	(reserved for future specification)
	1111	INTERIM

FIG. 29A

subunit_type

00000	Video monitor
~	(reserved)
00011	Disc recorder/ Player
00100	Tape recorder/ Player
00101	Tuner
00111	Video Camera
~	(reserved)
11100	Vendor unique
11101	reserved
11110	Subunit type extended to next byte
11111	Unit

FIG. 29B

opcode:Operation Code

00h	VENDOR-DEPENDENT
50h	SEARCH MODE
51h	TIMECODE
52h	ATN
60h	OPEN MIC
61h	READ MIC
62h	WRITE MIC
C1h	LOAD MEDIUM
C2h	RECORD
C3h	PLAY
C4h	WIND
~	~

FIG. 29C

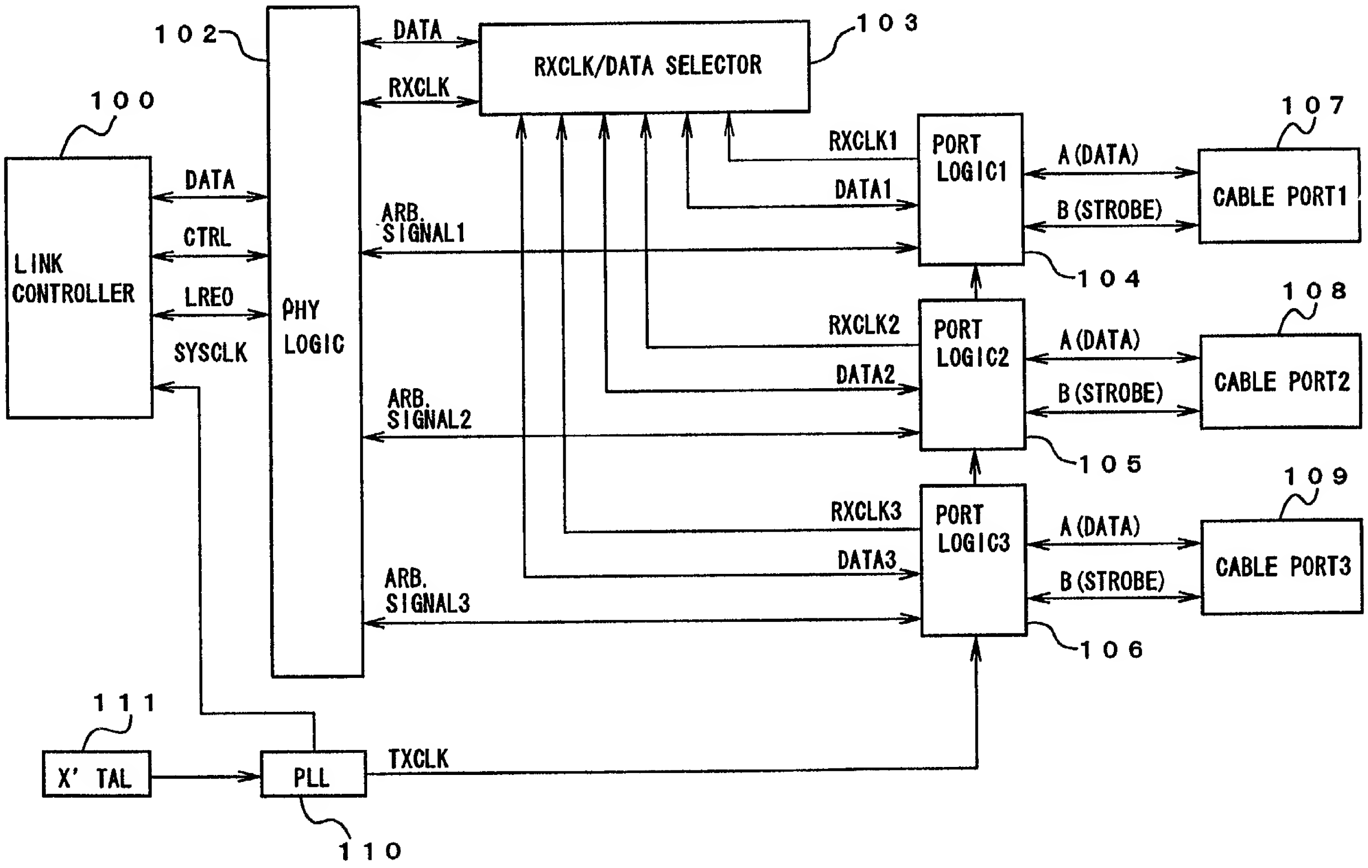
FIG. 30A

AV/C	control	tape recorder /player	IN THE CASE OF ID0	PLAY	FORWARD
CTS= 0000	ctype= 0000	subunit type= 00100	id= 000	opcode= C3h	operand= 75h

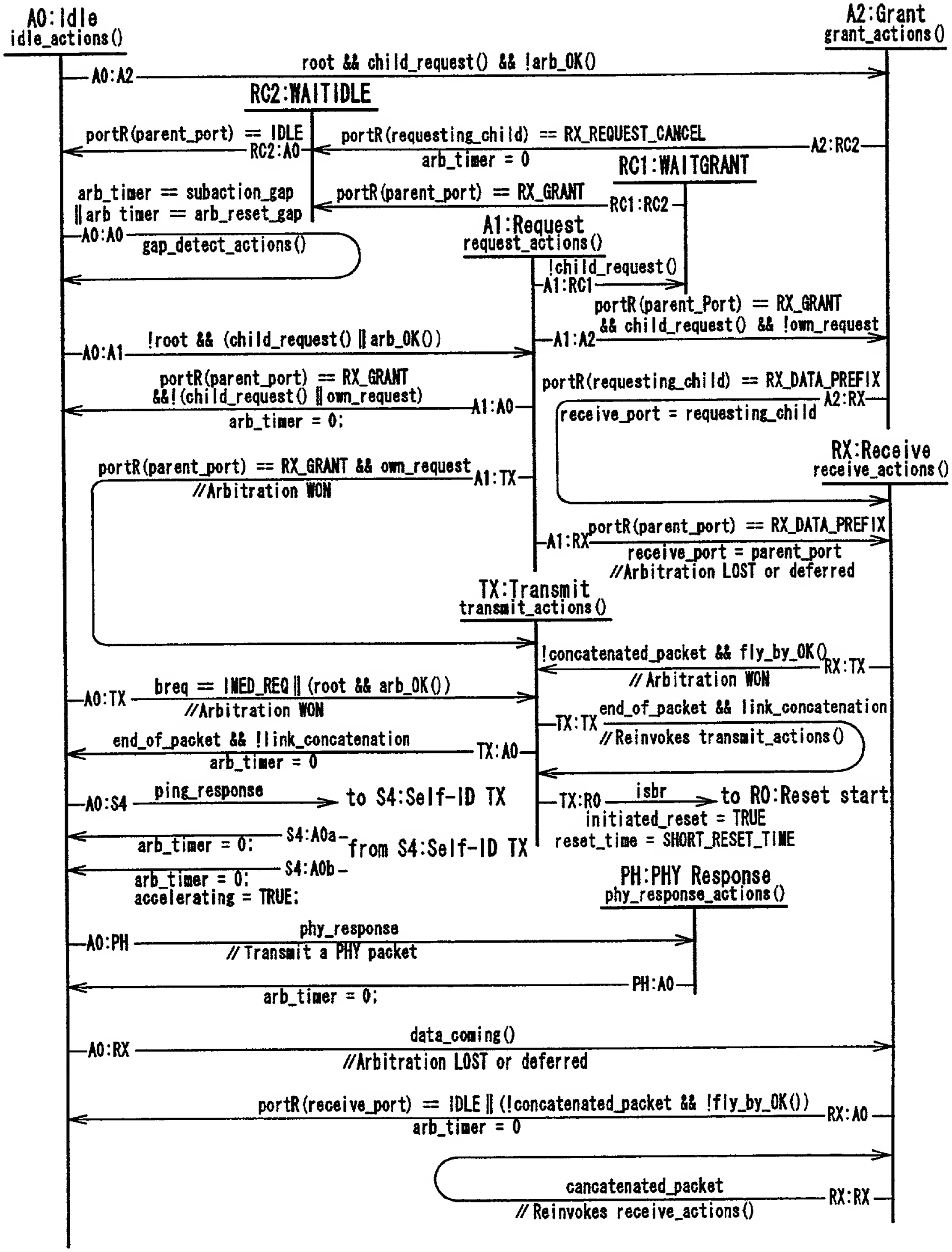
FIG. 30B

AV/C	accepted	tape recorder /player	IN THE CASE OF ID0	PLAY	FORWARD
CTS= 0000	response =1001	subunit type= 00100	id= 000	opcode= C3h	operand= 75h

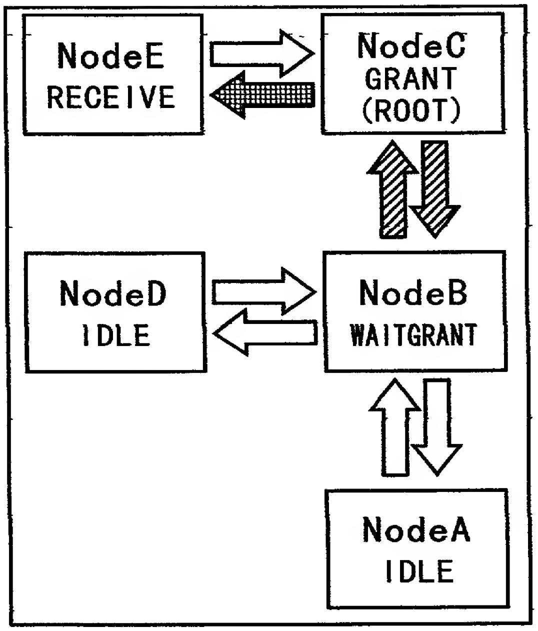
FIG. 31


100
LINK CONTROLLER
DATA
CTRL
LREQ
SYSCLK
102
PHY LOGIC
DATA
RXCLK
103
RXCLK/DATA SELECTOR
ARB. SIGNAL1
ARB. SIGNAL2
ARB. SIGNAL3
RXCLK1
DATA1
RXCLK2
DATA2
RXCLK3
DATA3
PORT LOGIC1
PORT LOGIC2
PORT LOGIC3
104
105
106
A (DATA)
B (STROBE)
A (DATA)
B (STROBE)
A (DATA)
B (STROBE)
107
CABLE PORT1
108
CABLE PORT2
109
CABLE PORT3
111
X' TAL
PLL
110
TXCLK

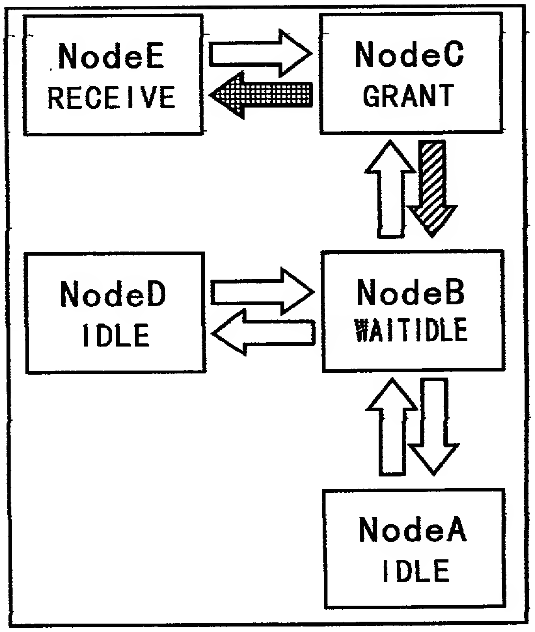
F I G. 3 2


A0:Idle
idle_actions()
A2:Grant
grant_actions()
A0:A2
root && child_request() && !arb_OK()
RC2:WAITIDLE
portR(parent_port) == IDLE
RC2:A0
portR(requesting_child) == RX_REQUEST_CANCEL
arb_timer = 0
A2:RC2
RC1:WAITGRANT
arb_timer == subaction_gap
‖arb timer == arb_reset_gap
portR(parent_port) == RX_GRANT
RC1:RC2
A0:A0
gap_detect_actions()
A1:Request
request_actions()
!child_request()
A1:RC1
portR(parent_Port) == RX_GRANT
&& child_request() && !own_request
A0:A1
!root && (child_request() ‖ arb_OK())
A1:A2
portR(parent_port) == RX_GRANT
&&!(child_request() ‖ own_request)
A1:A0
arb_timer = 0;
portR(requesting_child) == RX_DATA_PREFIX
receive_port = requesting_child
A2:RX
RX:Receive
receive_actions()
portR(parent_port) == RX_GRANT && own_request
A1:TX
//Arbitration WON
A1:RX
portR(parent_port) == RX_DATA_PREFIX
receive_port = parent_port
//Arbitration LOST or deferred
TX:Transmit
transmit_actions()
!concatenated_packet && fly_by_OK()
RX:TX
//Arbitration WON
A0:TX
breq == IMED_REQ ‖ (root && arb_OK())
//Arbitration WON
TX:TX
end_of_packet && link_concatenation
//Reinvokes transmit_actions()
end_of_packet && !link_concatenation
TX:A0
arb_timer = 0
A0:S4
ping_response
to S4:Self-ID TX
TX:R0
isbr
to R0:Reset start
initiated_reset = TRUE
reset_time = SHORT_RESET_TIME
S4:A0a
arb_timer = 0;
from S4:Self-ID TX
S4:A0b
arb_timer = 0;
accelerating = TRUE;
PH:PHY Response
phy_response_actions()
A0:PH
phy_response
//Transmit a PHY packet
PH:A0
arb_timer = 0;
A0:RX
data_coming()
//Arbitration LOST or deferred
portR(receive_port) == IDLE ‖ (!concatenated_packet && !fly_by_OK())
RX:A0
arb_timer = 0
cancatenated_packet
RX:RX
//Reinvokes receive_actions()

F I G. 3 3 A



F I G. 3 3 B



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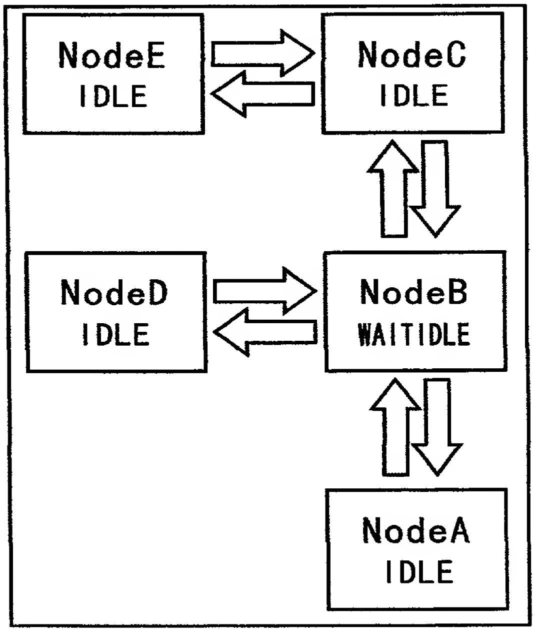

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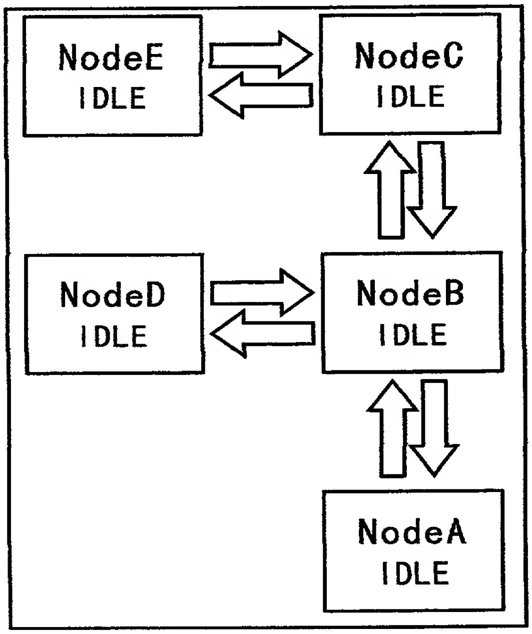

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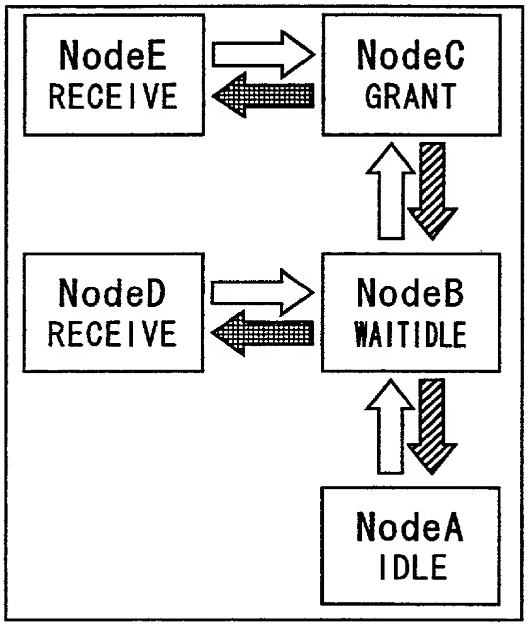

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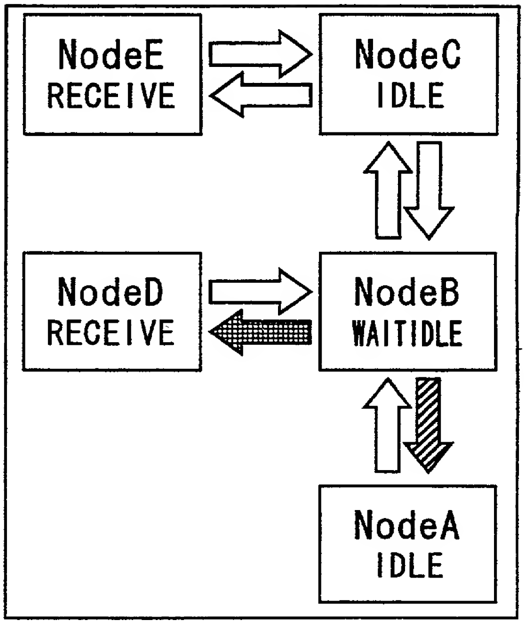

F I G. 3 4 C